ITTIL 67-1045 September 7, 1967

THIRD QUARTERLY REPORT

FOR

IMAGE DISSECTOR CAMERA SUBSYSTEM,

ASSOCIATED GROUND SUPPORT EQUIPMENT, AND

INTEGRATION SUPPORT FOR APPLICATIONS TECHNOLOGY SATELLITE

Contract NAS 5-10200

November 17, 1966 to February 17, 1967

Prepared By

ITT Industrial Laboratories
Fort Wayne, Indiana

For

NASA Goddard Space Flight Center
Greenbelt, Maryland

Approved By

E. W. Koenig, Manager
Applied Electronics Department

Dr. C. W. Steeg Jr., Director
Product Development

ABSTRACT

This technical report describes the efforts applied to the flight model Image Dissector Camera, the Ground Support Equipment, and the field service requirements of this program during its third quarterly period.

TABLE OF CONTENTS

1.0 INTRODUCTION

This program is effectively a continuation of NAS5-9671 under which the ITT Industrial Laboratories (ITTIL) is developing the engineering and prototype models of the Image Dissector Camera (IDC) for ATS and the Bench Checkout Unit (BCU) test sets for these cameras. Under this contract NAS5-10200, ITTIL will fabricate and qualify one flight model IDC, provide field services in support of the system, and construct two sets of ground support equipment (GSE) for processing data from the orbiting camera.

During this period, all printed-circuit assemblies for the flight camera were completed and module testing begun. Wiring of the housing was about 50 percent completed, but could not be carried further due to the unavailability of long-overdue control relays.

Construction of the first GSE was completed and system troubleshooting and testing begun. Fabrication of the second unit was also nearing completion with circuit updating and modifications being added as testing of the first unit progresses.

Field service activity commenced at the spacecraft contractor's facility late in this period with preliminary system compatibility testing of the engineering model camera.

2.0 FLIGHT MODEL IMAGE DISSECTOR CAMERA STATUS

Fabrication of flight model circuit boards and other subassemblies have been completed with the exception of the control relay group which still is held up for lack of relays. The manufacturer has experienced some difficulty in achieving qualification level performance with these devices due to seal leakage and a high level vibration contact bounce. These units are currently being reworked and then must be retested.

Module testing of the individual flight circuit cards is now underway with nearly half of the units all ready fully tested. As functional groups of cards become available, additional operational checks of the combined units are also being made.

Interconnection wiring and signal cabling within the flight model housing is approximately 50 percent completed. Because of wire routing and location of certain cables, work in this area has been discontinued until the relay harness can be next installed.

3.0 GROUND SUPPORT EQUIPMENT STATUS

During this period, the major portion of fabrication and construction work, on GSE unit No. 1 was completed and the task of checking out the various functional and self-test circuits of the system was begun. See Figure 3-1 for the block diagram of this equipment.

Additional design and development effort was directed toward the nutation correction technique and its circuitry. Calibration data for flight model sensor units made available by the manufacturer was used to make more precise calculations of output voltages for different nutation angles and of various spin rates. These calculations were used as the basis for determining the range of gain variations needed to obtain the proper setting in the correction circuitry for the expected spin rates.

The sample and hold circuit for use in the nutation correction circuit was refined during this period and its configuration is shown in the schematic diagram of Figure 3-2. Capacitor C3 is the sampling capacitor whose charging and discharging is controlled by Q3 and Q5. At all times other than the sampling interval, Q3 is biased on and the signal applied at the input of Q1 is effectively shunted to ground by Q3. Q5 is also turned on during this time, thus preventing C3 from charging to any voltage higher than the saturation voltage of Q5. At the beginning of the sampling interval, both Q3 and Q5 are turned off by negative pulses of their inputs. C3 therefore charges to the level of the input signal. At the end of the sampling interval, Q3 is turned on while C3 maintains the accumulated charge. Q5 is held off until either the D/A converter output voltage exceeds the sampled nutation voltage or the up/down counter driving the D/A has gone through its full range and reset to zero. CR5 is a blocking diode while CR3 and CR4 compensate for the transistor voltage offsets. Q7 and Q8 comprise a Darlington pair with high input impedance to minimize leakage of C3 during the comparison cycle. Q9 establishes a low output impedance with CR6 providing additional offset compensation.

The initial attempt to print out GSE generated data on the E1S photofax was not successful with the difficulty being traced to degraded pulse rise times on the clock line. Improvement of the GSE clock driver eliminated this problem and photographs of resolution, grey scale, and combinations have been made. Careful adjustments to both GSE output levels and photofax controls were required to achieve good reproduction of the full 13 shades of grey presented.

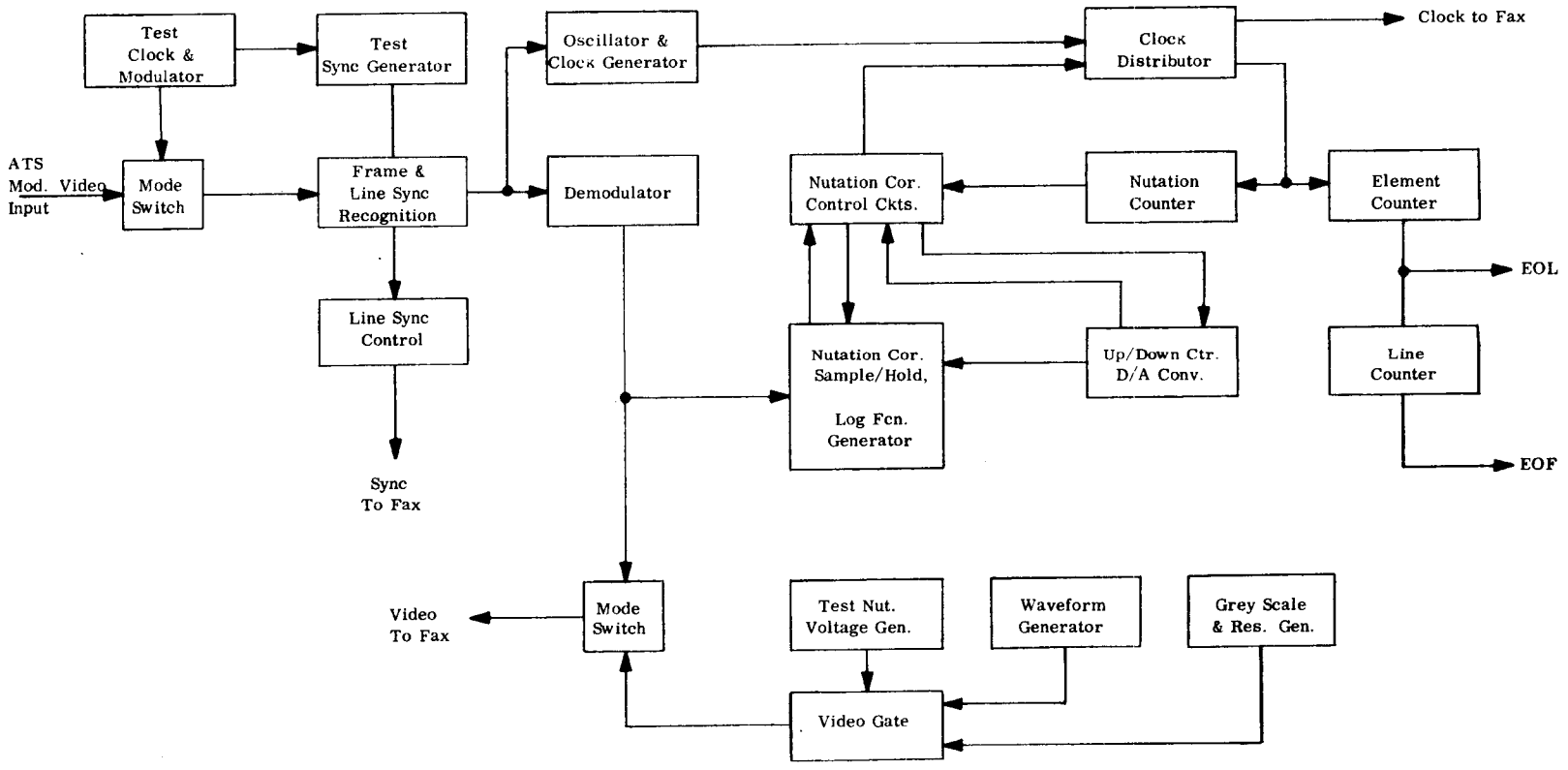

Figure 3-1 Block Diagram, Ground Support Equipment

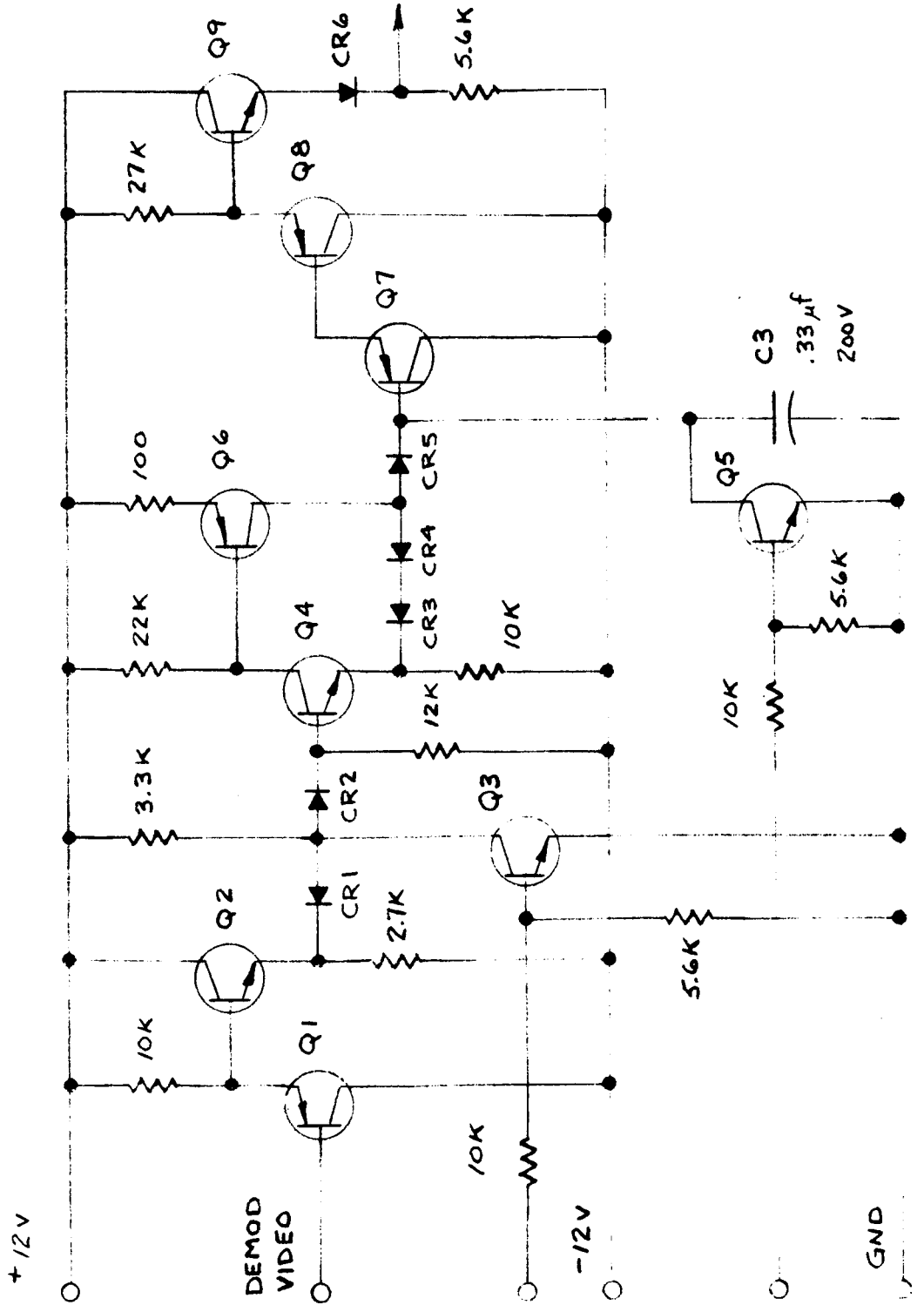

Figure 3-2 Schematic. Nutation Sample-Hold Circuit

4.0 INTEGRATION SUPPORT ACTIVITIES

Two ITTIL representatives established residence in El Segundo, California, to provide full time support of the IDC system at the facility of the spacecraft contractor, Hughes Aircraft Company. Initial activities there have included the receipt and setup of the engineering model camera and a bench checkout unit (from contract NAS5-9671) at HAC to check system interface compatibility and to undertake preliminary system testing on the EPC, an experimenters console equivalent to a rack-mounted spacecraft.

5.0 PROGRAM FOR NEXT PERIOD

Completion of module testing and system cabling of the flight model IDC will permit full system debugging and testing to be performed. With no unforeseen delays, the camera should be through or at least well into the environmental qualification testing cycle.

The first GSE unit will be acceptance tested and the second unit completed and into the final checkout and test phase.

Support activities will continue at HAC with the EM and prototype cameras. Other services deemed necessary or desirable to the successful completion of this program will be performed under the direction of the NASA technical officer.